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LA JOLLA

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SOUTHWEST FISHERIES CENTER

MONTHLY REPORT - FEBRUARY 1977

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SOUTHWEST FISHERIES CENTER
La Jolla, California

Honolulu Laboratory
La Jolla Laboratory
Tiburon Laboratory
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STATUS OF PUBLICATIONS

Published

Dotson, Ronald C. 1976. Minimum swimming speed of albacore, Thunnus alalunga. Fish. Bull., U.S. 74(4): 955-960.

Measurements of density and pectoral lifting area of albacore, Thunnus alalunga, were made and compared with those previously described for yellowfin tuna, Thunnus albacores; bigeye tuna, Thunnus obesus; and skipjack tuna, Katsuwonus pelamis. Albacore have densities within the range of yellowfin tuna of similar size. The pectoral lifting area of albacore was always greater than skipjack tuna but similar to yellowfin tuna and bigeye tuna for fish less than 70 cm long. Larger albacore had increasingly larger fins than did the other species.

Minimum speed necessary for hydrostatis equilibrium of albacore was calculated and compared at 50 and 80 cm fork lengths to values calculated for the species above. Albacore minimum speeds were slower than those for skipjack tuna, similar to those of yellowfin tuna, and greater than those of bigeye tuna. Density variations of albacore, attributed to fat content and gas bladder volume, significantly affected estimates of minimum speed. Calculated speeds were slower than those estimated for albacore tracked at sea or estimated from tag returns.

This report does not constitute publication and is for information only.

Hunter, John R. and Carol Sanchez. 1976. Diel changes in swim bladder inflation of the larvae of the northern anchovy, Engraulis mordax. Fish. Bull., U.S. 74(4): 847-855.

Laboratory and field studies demonstrated that larval anchovy 10 mm standard length and larger inflate their swim bladders each night and deflate them in the day. Maximum night levels of inflation were attained 2 h after the onset of dark and typical day levels occured about 2 h after the onset of light. Laboratory experiments indicated that larvae fill their bladders at night by swallowing air at the water surface and the vertical distribution of sea-caught larvae suggested that they migrate to the surface each night to fill their swim bladders. Gas is released by passing bubbles through the pneumatic duct into the alimentary canal. The diel rhythm of inflation was viewed as an energy sparing mechanism. Measurements of sinking speed of larvae with and without inflated bladders suggested that the energy saved at night by inflation of the swim bladder would exceed the cost of vertical migration to the surface and that the migratory range over which energy savings are possible would be greater as larvae increased in length.

Translation

Japan Marine Fishery Resource Research Center (JAMARC) 1973. Surveys of trawling grounds in the north central Pacific Ocean, 1972 season (Showa 47-nendo kaigai tororu shingyojyo kigyoka chosa hokokusho--Hokubu chuo Taiheiyo kaiiki). Translation of portions of JAMARC Report No. 7, 89 p. (Translated from the Japanese by Tamio Ostu, 1977, 27 p., Translation No. 19.)

Approved by Center Director

Lenarz, William H. and James R. Zweifel. "A theoretical examination of some aspects of the interaction between longline and surface fisheries for yellowfin tuna (Thunnus albacares)." For publication in the Fishery Bulletin, U.S.

HONOLULU LABORATORY

RESOURCE ASSESSMENT AND DEVELOPMENT INVESTIGATIONS (RADI)

Task Objectives Defined for the Fishery Management Research Task

The Fishery Management Research Task at the Honolulu Laboratory, under the direction of Acting Task Leader Dr. Jerry A. Wetherall, is responsible for a broad range of research activities arising from the Fishery Conservation and Management Act of 1976 (FCMA). Task responsibilities include

(1) providing background documents, technical information, and expertise for management planning teams of the Western Pacific Regional Fisheries Management Council, (2) making scientific assessments of fish stocks targeted for management by the Council, (3) determining fishery research requirements and developing statistical systems for improving fishery management performance in the western Pacific region, and (4) developing the theoretical basis and practical methodology for fishery management policy analysis.

During February task members were active in all four areas. Mr. Howard Yoshida, Fishery Biologist, assembled background information on spiny lobsters and began work on a draft management plan for the Hawaiian lobster fishery. His work includes an evaluation of alternative fishery regulations and information needs for effective management. Dr. Wetherall, together with Mr. Heeny Yuen, Leader of the Recreational Fisheries Task, did some early planning towards a Pacific Billfish Stock Assessment Workshop which will be convened in Honolulu during December 1977. The workshop will bring together a small group of billfish scientists from the major harvesting nations in the Pacific to examine all available billfish statistics with a view to estimating the size of major billfish stocks and current exploitation status.

In the area of policy analysis, Dr. Roy Mendelssohn continued working on theoretical aspects of multi-objective decision making. He prepared a brief paper discussing some of the problems which management planners face in developing policy under the FCMA, and summarizing several analytical approaches which may assist Councils in making policy decisions in a multi-objective setting. The paper was made available to members of the Western Pacific Regional Fisheries Management Council and its Scientific and Statistical Committee.

Catch and Effort Summaries Completed for South Pacific Albacore Fishery

Dr. Robert Skillman, Leader of the Resource Monitoring and Assessment Task at Honolulu reported that Mrs. Sally Kuba has completed the quarterly summarization of catch and effort statistics for the South Pacific albacore fishery. The summaries included final statistics for 1975 and preliminary statistics for 1976. These summaries are provided to the Office of Marine Resources; the tuna industry concerns having an interest in the South Pacific tuna resources, and, for the first time, the South Pacific Commission. The year 1975 was the worst year in the history of the fishery, not only for total albacore catch but also for CPUE. The winter peak in CPUE never materialized, possibly because less fishing effort was expended in the southern areas of the fishery in an attempt to save on fuel costs. In 1976, the situation improved with the usual low for February not as severe and the winter peak approaching that of 2 years ago.

Impasse Resolved on Details of Cooperative Study of the Northwestern Hawaiian Islands (NWHI)

For several months, representatives of the Honolulu Laboratory, NMFS, the U.S. Fish and Wildlife Service, and the Hawaii Division of Fish and Game have been trying to develop a formal Tripartite Cooperative Agreement for a cooperative study of the living resources of the NWHI. Dr. Robert Skillman, coordinator of the study, reported that a meeting held at the Honolulu Laboratory this month, the remaining problems were worked out to the satisfaction of the participants at the field level. With the addition of a statement of relevant State laws, a final draft agreement will be sent to the Director, NMFS, the Director, U.S. F&WS, and the Chairman, Hawaii Board of Land and Natural Resources for each's review and signature.

At the request of Mr. Howard Pennington, Office of Marine Affairs, the Governor's staff, State of Hawaii, Dr. Skillman prepared a statement describing the cooperative study for presentation to the Hawaii State House of Representatives, Ocean and Marine Resources Committee. Because of time limitations the committee could not hear Dr. Skillman's testimony; however, the written statement was entered into the official record of the Committee.

Also, in anticipation of the final signing of the agreement Dr. Skillman began working with the State Division of Fish and Game on their participation in a forthcoming Townsend Cromwell Cruise (TC-77-02) scheduled for May 2 to August 12, 1977.

"Ghost Fishing" and Tagging Experiments Conducted on Spiny Lobsters

Because of the increased fishing effort for spiny lobsters in the NWHI and the concomitant loss of lobster traps, there is a need to determine whether the lost raps "ghost fish," i.e., continue to fish and entrap lobsters. An opinion was expressed by a commercial fisherman that the traps now in use allowed the lobsters to enter and exit at will. However, Research Assistant Thomas Kazama reported that lobsters remained for 2 days and did not escape in unbaited traps in experiments conducted in pools at the Kewalo Research Facility. Lobsters freely entered unbaited traps and traps without any other lobsters inside. It appears desirable to run these same tests under more natural conditions in sea trials.

Mr. Kazama also conducted tag retention trials on spiny lobsters. He tagged 160 lobsters in various combinations with respect to type of tags and tagging locality. A mortality of 31 lobsters was experienced as of February 23. Sixty-one percent of the mortality occurred among lobsters tagged with the Floy FD 68A tag between the carapace and the first abdominal segment. Five tagged lobsters molted during the month and four of them retained the tag through the first molt; however, two of these died 48 hours after molting. The experiments are continuing.

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Mr. Tamio Otsu, RADI Chief, completed a translation of sections of a Japanese report on seaweeds for Helen Mustafa of the Northeast Fisheries Center, Woods Hole, Massachusetts. He also completed Translation No. 19, another of a series of translations of Japanese articles on seamount resources in the Pacific Ocean.

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Mr. Uchida continued work on a draft report of the fishery resources of the western central Pacific and started a second draft report on the fishery resources of the central Pacific Ocean.

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Other Insular Fishery Resources Task staff at Honolulu were engaged in various other activities. Mr. Thomas Hida, Fishery Biologist, is on board the NOAA vessel Miller Freeman, which is operating in Alaskan waters, to observe bottom trawling operations on the Miller Freeman. Research Assistant Paul Shiota continued to repair fish traps and lobster pots, and began fabricating an experimental bottom longline.

Research Assistant James Uchiyama prepared otoliths for reading. The samples included material collected in the equatorial western Pacific, juvenile albacore otoliths collected by Dr. Mike Laurs, La Jolla Laboratory, Southwest Fisheries Center, and otoliths from juvenile mahi mahi, Coryphaena hippurus. Mr. Uchiyama also briefed and debriefed the sea going observers on the commercial vessels fishing in NWHI waters.

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Dr. Mendelssohn accompanied Mr. Gordon Broadhead, of Living Marine Resources, to American Samoa where they evaluated the mollie rearing projects of the Government of American Samoa. Mollies are being reared in an attempt to provide a tuna bait supply.

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Ms. Marian Yong, Mathematician at the Honolulu Laboratory, worked with Dr. Wetherall during the month to prepare for a reassessment of the North Pacific albacore stock. She also combined a series of computer programs for estimating tag shedding rates in double-tagging experiments and produced a set of tables giving the sample sizes necessary for desired precision in shedding rate estimates. The sample size tables and computer programs are based on statistical procedures developed by Dr. Wetherall last year. The results of this work will be published in a pair of papers. A non-mathematical one, just completed, is aimed at biologists planning double-tagging experiments, and includes the computer program, sample size tables, and a discussion of some basic aspects of experimental design. A second paper, now being revised, gives a theoretical treatment of the maximum likelihood estimation procedures and is intended for a more technical audience.

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Dr. Skillman was involved in various other activities at Honolulu during the month. He updated the catch statistics section of the manuscript, "Synopsis of biological data on skipjack tuna, Katsuwonus pelamis (Linnaeus)" authored by Walter M. Matsumoto and Robert A. Skillman. As chairman of the Honolulu Laboratory's vessel committee, Dr. Skillman convened a meeting to review the shiptime needs of the various Laboratory tasks. The committee also met to consider the acquisition of a shipboard computer system to automate certain data recording and preliminary data processing procedures.

Dr. Skillman also met with Laboratory users of the computer terminal system to evaluate the first year's operation of the system. Major points that emerged at the meeting were that (1) the Hawaiian Telephone Company did not provide the support necessary to utilize the system effectively, (2) the system is, in some respects, too sophisticated for the Laboratory needs, and (3) the system is too cumbersome when using APL (A Programming Language). The consensus of the group was to continue to lease the present system until such time as a more suitable system for the Laboratory's needs can be found.

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Mr. Ray Sumida reported that the data processing section has started to transfer Honolulu Laboratory data that are presently on cards to tapes. The data are being checked for accuracy and completeness before being placed on tapes. Also, plans for microfiching original data, backup tape storage, maintenance, and original data storage are presently being considered.

Mrs. Lucille Tsukano is checking the Hawaii State Fish and Game catch and bait data for January-September 1976, for consistency and accuracy before punching the data on cards. Mrs. Sally Kuba is checking the Laboratory's longline catch data and correcting any discrepancies. A summary of the relative depth of capture and the number of fish landed alive for all the billfishes captured on the Laboratory's past longline cruises will be prepared by Mrs. Kuba. This work is being done at the request of Mr. Yuen and Dr. Wetherall.

Mr. Sumida is also continuing work on the preparation of a manual for standard operating procedures for the Honolulu Laboratory's NWHI cruises. The work is about two-thirds complete.

Early 1977 Estimated Hawaii Catch of Skipjack Tuna Continues Above Long-Term Average

The January 24 to February 20, 1977 Hawaii landings of skipjack tuna were estimated at 330 MT (metric tons), which is 210 MT above the 1976 landings for the same period and 225 MT above the 1948-1976 long-term average.

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Pulou Nuiatoa, employee of the Government of American Samoa, recorded the lengths of 1,264 albacore from 27 vessels during the period from January 1 to February 11, 1977. He also collected 22 sets of catch and effort data. Based on data from five vessels the average size of albacore for the period was 93.6 cm and the catch rate averaged 2.62 albacore per 100 hooks.

FISH-ENVIRONMENT INVESTIGATIONS (FEI)

Preparatory Work for Experiments on Tuna Continues in the Experimental Ecology of Tunas Task

Dr. Andrew Dizon, Leader of the Experimental Ecology of Tunas Task at the Honolulu Laboratory reported that members of the task continued preparations for experiments for the upcoming season. These experimental activities will include the determination of the effects of environmental temperature on the activity and body temperature of yellowfin tuna, the development of a system to force-swim tunas, a study of the effects of turbidity on tuna behavior, and the measurements of active respiration in tunas. Presently four yellowfin tuna are on hand for experimental purposes.

Dr. Dizon is still awaiting a shipment of temperature transmitting tags from the Oak Ridge National Laboratories. He has received a test circuit of an ultrasonic transmitter than can transmit muscle action potentials from free-swimming tunas. The tag worked well when tested on restrained fish and is now being packaged for underwater use. Output of the tag can discriminate between red and white muscle activity.

Heaters have been replaced in the behavioral thermoregulation tank and the system will be operational soon for the yellowfin tuna tests. The swimming tunnel is nearing completion and has already undergone several tests. Dye tests will be initiated soon to determine flow characteristics within the swimming chamber.

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Dr. Dizon reported that the proceedings of the tuna physiology workshop held recently at the SWFC in La Jolla will be published by Academic Press. Dr. Gary Sharp, Inter-American Tropical Tuna Commission and Dr. Dizon will be editors.

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Mr. Yuen worked on the preparation of material for a workshop on tuna and billfish identification. The workshop is being planned for recreational fishermen and is part of the program of the 5th Bay of Islands Billfish Tournament to be held in March at Russell, New Zealand. Mr. Yuen also completed a draft of a logbook that will be used to collect data on recreational fishing on pelagic species. This work is part of a cooperative project with the Hawaii State Division of Fish and Game.

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Dr. Richard Barkley, FEI Chief, noted that his manuscript on skipjack tuna habitat, sent out in late January, was reviewed and returned only 1 week after it arrived at the Fishery Bulletin editor's desk. The MS is being revised in response to the reviewer's and editor's comments. Dr. Barkley also reviewed a manuscript and two National Science Foundation proposals. He also resurrected from his old island wake files preliminary plans for joint studies with the NWAFC of seamount oceanography and ecology and sent them to his colleagues in Seattle for consideration.

LA JOLLA LABORATORY

Coastal Fisheries Resources Division

ALBACORE FISHERIES PROGRAM

Dr. R. Michael Laurs and Mr. Ronald Lynn attended the Board of Directors meeting of the American Fishermen's Research Foundation held in San Diego in mid-February to propose new and continuing albacore research studies to be conducted cooperatively by NMFS-AFRF during 1977. The AFRF Board of Directors approved the proposed studies which include 1) exploratory/research survey to further evaluate the feasibility of jig-fishing for albacore by U.S. vessels in the western Pacific, 2) extensive tagging program of the "southern" group of albacore as part of a study of migration patterns of this group of fish, 3) late season exploratory/research survey in waters between southern California and Hawaii in conjunction with item (2), and 4) possibly the use of one or two chartered fishing vessels to conduct fish scouting/research activities during the fishing season in areas away from where the commercial fleet is operating.

Dr. Laurs, Leader of the Albacore Fishing Investigations gave a talk dealing with the results of albacore research studies conducted cooperatively by NMFS-AFRF to the Western Fishboat Owners Association Board of Directors meeting held in San Diego in early February. The presentation was very well received by the audience and the WFOA reaffirmed their support of the research program.

Dr. Laurs was named to the NOAA Coastal Zone Color Scanner Technical Review Committee and attended a meeting of the Committee which was held in mid-February in Washington, D.C. to review and comment on a draft issue paper dealing with NOAA's involvement in the evaluation and application of the CZCS system, which will be part of the sensor package aboard the NIMBUS to satellite, as a took for accomplishing NOAA responsibilities.

Messrs. K. Bliss and R. Dotson worked on the machine digitization of salinity. Temperature and dissolved O_2 versus depth analog traces and the conversion of these to mag tape compatible with existing programs. These traces were collected at stations on the albacore oceanography cruise last

June. The visual method of data collection by mag tape failed during the cruise. Mr. Lynn is designing a monitoring system for the oceanographic instrument to prevent future data loss. The system will provide for at sea data processing as well.

LARVAL FISHES, COASTAL EASTERN PACIFIC PROGRAM

Anchovy Larvae to be Reared to 6 mm for Crucial Shipboard Experiment

Dr. R. Lasker, Leader of the Coastal Fisheries Resources Division, Dr. C. Barry, Fishery Biologist, and Ms. M. Pollock, Biological Technician at La Jolla have been preparing for a field experiment to determine criteria for survival of anchovy larvae 6 mm in length and larger. Dr. Lasker has shown in earlier work that first-feeding larvae can be taken to sea and used as a bioassay for good and bad feeding grounds and thus has been able to chart where first-feeding anchovy larvae might be expected to have good survival. However, there is a behavioral change in the 6mm anchovy larva which is reflected in the larger sizes of particles it must eat. The logistics for this experiment are prodigious, since larvae must be reared in the laboratory for several weeks, then taken to sea and permitted to feed in natural waters brought on board the ship. Because larvae are extremely delicate at this age and length, this experiment has never been done before. Dr. Barry and Ms. Pollock worked out the details for temperature regulation and timing of growth of the larvae in the laboratory this month so that 6 mm larvae will be available when the cruise for testing this technique is held aboard the NOAA vessel Jordan in March.

Advances Made in Prey Microstructure Research

Work on description of microstructure of biological substances, including food on anchovy larvae, was continued with assembling and punching for computer analysis of all microscope counts, plant pigment concentration, nutrients, salinity, oxygen and Coulter counts observed at 20 cm intervals, together with physical characteristics such as current shear, stability and particle diffusivity.

In cooperation with Jim Zweifel, the data will be machine analyzed for least significant differences, correlations between population densities observed, and statistical descriptions of the variations of each parameter measured.

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Robert Ando, Scripps graduate student, is working with Dr. Owen on optical signatures of particle concentration, in hopes of finding a simple yet significant measurement to take the place of the labor-intensive microsampler casts presently required to measure small scale variations in situ.

Owen and Ando also are working on the simultaneous microscale measurement of temperature and salinity to determine the degree to which stratification of biological material responds to small vertical variation of density.

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Both Dr. Owen and Mr. Ando began preparation for their March cruise on the D.S. Jordan, to measure microstratification in the mixed layer with microsampler beam transmissometer and two in situ particle counting devices developed by Dr. Ed Scura and Mr. Jack Brown.

A set of horizontal tows using the phytoplankton pump is planned for the March cruise by Dr. Owen to test his theory that vertical circulation patterns in the mixed layer of the ocean may locally concentrate certain plankters sufficiently to exceed the minimum concentration needed to feed fish larvae. One testable condition is the "Langmuir" circulation, regularly convecting vortices marked more or less clearly by windrows (downwelling convergences between a vortex pair) wherein floating or upward-swimming particles will concentrate. Halfway between windrows, at the bottom of the convecting layer, are upwelling convergences, in which we can expect concentration of sinking particles.

Anomalously high proportions of copepod eggs are found in many fish larvae, including those of the northern anchovy. One likely way that this can occur is by fish larvae encountering the sinking eggs in high concentrations provided by the upwelling "traps" between vortices. Fish larvae can find these zones of high food concentration by behaving like a particle--sinking (or rising) slowly will be sufficient to carry them to the upwelling (downwelling) convergence zone with a minimum expenditure of energy.

Dr. Owen presented results to date of the microstructure work at a seminar at the Southwest Fisheries Center on February 7, showing the sometimes surprising (and largely unexplained) variation of population densities, nutrients, etc. so far detected, and assigning at least part of the degree of stratification to physical causes.

Study Focuses on Integration of Spatial Spectrum with Deterministic Behavioral Model for Larval Anchovy

Dr. W. Vlymen's recent study at La Jolla of the relationship between prey micro-structure and larval anchovy growth demonstrated that fixed geometrics of prey microdistribution yielded distinctly different average growth rates when consideration was also given to environmental modulation of larval behavior. The geometric structure of the prey micro-distribution used in that study, although having characteristics of a mass conserved system, was, however, artificial. The reason for using this artificial system was due primarily to the lack of knowledge concerning the geometric distribution of prey important to the larval anchovy at small scales in the ocean.

However in the last 5 years, a large body of data has been collected using the techniques of spectral analysis in studying spatial variance of phyto- and zooplankton in the sea. These studies have revealed a striking similarity to spectral curves of other scalar fields in the ocean at scales of between 1 to 10 km. Other work in more undisturbed waters has shown coherence between temperature and phytoplankton variance at scales as low as 5 to 10 m. However, in general, scales in the ocean less than 100 m are thought not to be related directly to passive scalar properties mediated by the turbulent velocity field. Thus, at scales less than 100m, which are of importance to anchovy larvae, what is needed is some way of estimating the variance spectrum of small particles of variable density in a given turbulent field of specified strength. It is known from turbulence studies by Soviet workers that the Kolmogorov five-thirds law for the energy spectrum is valid in the .01 to 1 m region. The relationship between the variance spectrum of the water and particles suspended in it may be analyzed, granting the satisfaction of certain assumptions, by the method of Tchen. Thus knowing the density ratios of the particles and suspending fluid, the variance spectrum for the particle can be approximated given the energy spectrum of the fluid is known. This new variance spectrum for the .01 to 1 m wave number range can then be interfaced with the behavioral and random walk model Dr. Vlymen has already completed. It is the exact mechanics of integration of this spatial spectrum with the deterministic behavioral model that has been the main focus of his work this month.

Morphological Condition of Anchovy Larvae Compared in Good and Poor Survival Years

Dr. David K. Arthur, NRC/NOAA Research Assistant at the La Jolla Laboratory, has found that the morphological condition of anchovy larvae (about 6 mm in length) was poorer during April of a good year for survival (1963) than in April of a poor year (1965). Research for the past 2 months has been on samples taken during January of these same 2 years.

Preliminary results indicate that in January the morphological condition of anchovy larvae was also generally better in the good year for survival. In both years, the condition of the larvae was higher in April than in January.

The condition of larvae in January of the good year for survival averaged about the same as that for larvae in April of the poor year.

Initial Results Available on Effects of Starvation for Early Pacific Mackerel Larvae

Dr. C. O'Connell reports that microscope study of histological sections of fed and starved Pacific mackerel larvae was started recently to compile a description of development and the effects of starvation on early larvae for this species. Initial indications are that organogenesis occurs rapidly after hatching (at 19° C), and that unfed larvae show signs of starvation by age 4 days. At age 1 day (24 hours), the eyes show some pigmentation, but the yolk is still prominent and neither the branchial apparatus nor digestive

tract has developed to a functional state. By 2 days, however, yolk is reduced about 70%, gill arches and jaws are well defined, and the eosophagus, stomach and intestine are differentiated. Liver, pancreas and spleen are identifiable and appear to be functional, and the gas bladder, a solid rudiment on the first day, appears to be inflated. Most larvae had erythrocytes in the circulatory system, and many in the fed group had food in the digestive tract.

At age 4 days the oil drop and some yolk remnants were still present in both fed and starved larvae, but the starved larvae showed a degree of cell size reduction and separation in the pancreas, liver, and spleen, and in the trunk musculature. These signs of emaciation are similar to those already described for the anchovy, but it is interesting that they appear relatively early in the mackerel, while some portion of the yolk sac contents, i.e., the oil drop, is still present.

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To obtain avoidance corrections for anchovy larvae collected at different times of the day, Mr. J. Zweifel, Mathematician at the La Jolla Laboratory, has re-examined the sized larval data using the weighted negative binomial model. When corrected to a standard temperature and standard volume of water through the net, the contagion coefficient k was shown a) to be independent of density (i.e., time of day) for the same size class, and b) to increase to 9.75 (average preserved length) and decrease therafter as shown below:

Size	k
2.50	.0436
3.75	.0554
4.75	.0645
5.75	.0730
6.75	.0803
7.75	.0865
8.75	.0905
9.75	.0913
10.75	.0860
11.75	.0762
12.75	.0633
13.75	.0588
14.75	.0468
15.75	.0404
17.25	.0358
19.25	.0283
21.25	.0358
23.25	.0176

These results indicate aggregation processes separate from schooling behavior which does not occur in the laboratory until somewhat later at about 15 mm (live length).

COMMERCIAL AND RECREATIONAL RESEARCH FOR MANAGEMENT PROGRAM

Material Prepared for Anchovy Management Plan

Dr. Dan Huppert, Leader of the Commercial and Recreational Fisheries Research for Management Program at the La Jolla Laboratory, devoted most of the month to preparation of material for the anchovy fishery management plan which is in progress. Dr. Huppert, along with Dr. Stauffer, is a member of the Pacific Council's Anchovy Plan Development team. The backlog of commercial information on the U.S. fish meal industry was reviewed, and data were compiled for use in an analysis of demand for fish meal. Also, in cooperation with Alec MacCall, Fishery Biologist with CF&G (and also a member of the planning team), a computer model was developed which calculates the optimal yield of anchovy under specific criteria, assuming that the stock dynamics conform to a model proposed by MacCall.

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On February 15, Dr. Huppert traveled to Stanford University to participate in a seminar sponsored by the Center for Technology Assessment and Resource Policy (CTARP). The seminar was attended by graduate students in engineering, NOAA fellows participating in a NOAA-sponsored educational training program, and staff of CTARP (including Dr. John McAlister, the director).

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Gary Stauffer at the La Jolla Laboratory also reviewed the literature on the identification and distribution of three subpopulations of the northern anchovy, Engraulis mordax. The purpose of this review was to document the management unit for the anchovy management plan being prepared for Pacific Fisheries Regional Management Council. Based on this review, the management unit was limited to the central subpopulation. This subpopulation ranges from approximately 38° N, just north of San Francisco, California, to approximately 30° N, near Punta Baja, Baja California, Mexico and extends offshore to approximately 200 miles. The central subpopulation is relatively homogeneous throughout its range and yet is distinct from both the northern and southern subpopulations. The central subpopulation is the target of both Mexican and American anchovy fisheries.

Rockfish Research

Mr. John MacGregor, Fishery Biologist at the La Jolla Laboratory, continues to examine otoliths and scales of various species of rockfish for determination of best methods of determining age. One of the main problems is that there are a large number of species of rockfish--about 50 off the

California coast. To date, Mr. MacGregor has examined specimens of 18 species. A further problem is that the samples of rockfish available for study were obtained from the sportfishery and appear to be inadequate for analysis.

Otoliths collected to date appear to be very difficult to read with any accuracy. Scales are somewhat better except that some species of rockfishes have few if any scales that are not regenerated. Mr. MacGregor reports that he is presently using the following tentative method of aging rockfish: First, annuli of six scales from a fish are marked and the lengths back-calculated for each scale. Readings that do not match for at least four of the six readings are discarded. This seems to give reasonable results although additional work needs to be done.

In addition, Mr. MacGregor is measuring samples of small fish-of-the-year in order to estabish first year growth for those species that are available. In late March, he plans to participate in the cruise aboard the NOAA research vessel, Jordan, to collect samples of rockfish by conventional fishing and trawling to obtain more specimens and species for this study.

Mr. Keith Parker, Statistician at La Jolla, reviewed various reports and methodologies on sampling fisheries for biological and socio-economic data. This included creel surveys conducted by CF&G under contract by NMFS and the telephone or postcard type surveys being considered by NMFS, Washington, D.C. Mr. Parker will be responsible in the Extended Jurisdiction group for reviewing and critiquing such surveys.

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Mr. Parker has also been working on two papers for publication based on his Master's thesis entitled, "Variable area transect estimation of population density." The first paper describes the methodology of estimating the density of a population where the survey path has a fixed width and variable length depending on when a predetermined number of organisms are encountered. He proposes this method as an alternative to quadrats and nearest neighbor estimates of population density used in wildlife management. He has applied this method to estimating the density of Pismo clams he collected in cooperation with CF&G during a recent clam survey of Seal Beach and it appears to work quite well. The second paper uses the same scheme to test for randomness of points in a plane.

The derivation of two tests based on the beta distribution and an approximate normal distribution have been completed. Currently, Mr. Parker is looking at the power of such tests.

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Joseph Caruso, Mathematical Technician in the Extended Jurisdiction group, continued to revise the coding format for the data base being developed for Fishery Biologist Jim Squire's Aerial Marine Resource Monitoring

System. Flight logs will be divided into two data bases, one for sighting records and the other for effort records. Specific forms were drawn up for ease of coding and keypunching. Sample flight logs have been coded to test the instructions and form design. The next steps are to complete the instruction document describing the coding procedures and to write a FORTRAN data edit program to screen the data for errors prior to putting the data onto the data base system.

MULTISPECIES TAXONOMY PROGRAM

Efforts Continue to Update Identification of Fish Larvae in CalCOFI Samples

The staff of the Assessment Program, La Jolla, are involved primarily with the following activities: 1) identification and enumeration of samples taken on CalCOFI collections, 2) description of life history series of Pacific marine fishes, together with information on distribution and ecology and 3) service functions--including presentation of courses in the identification of fish eggs and larvae, review of manuscripts, aiding visiting scientists in identification of fish eggs and larvae, and on research problems.

According to Dr. Elbert Ahlstrom, Leader of the group, they are making a determined effort to bring CalCOFI identifications of fish eggs and larvae completely up to date, and all members of the group are helping in this area. Only one cruise of the 1972 CalCOFI year remains to be completed--7202--and three persons are working on this cruise, which had extensive coverage.

During the 1975 CalCOFI year, six extensive cruises were made, most with upwards of 300 samples per cruise. Fish larvae samples taken on two of these cruises, 7412 and 7503, are identified and enumerated; two others, 7501 and 7505 are being processed, and two cruises remain to be worked up. One of these, 7510, is still being sorted for fish eggs and larvae, hence is not yet available to the fish identifiers.

One of the cruises conducted in 1972 was discussed by Dr. Ahlstrom and Biological Technician Elizabeth Stevens in the latest published CalCOFI Reports (vol. 18: 167-180) in a paper titled, "Report on neuston (surface) collections made on an extended CalCOFI cruise during May 1972." A comparison is made of catches of neuston net and oblique CalCOFI hauls. Although this CalCOFI Report is dated May 1976, it was only published and distributed recently.

Two of the research projects that are nearing completion are: 1) a description of the late larvae and pelagic juveniles of the rockfish, Sebastes and 2) a paper dealing with eggs and larvae of pleuronectid flatfishes with heavily pigmented early life history stages, i.e. four species of Pleuronichythys and also Hypsopsetta guttulata.

The class reference collections of fish eggs and larvae is being augmented in order to have fresh material and additional collections of the series to be studied in the MARMAP training course on identification of fish eggs and larvae, to be given at the Center September 12 through October 7, 1977.

MULTISPECIES, COASTAL EASTERN PACIFIC (CalCOFI) PROGRAM

U.S. Cooperates with Soviets in Fisheries Survey

With NMFS Fishery Biologists Robert Counts and William Flerx of the La Jolla Laboratory, aboard the 190-foot fishery research vessel, Ogon, operated by the Far Eastern Seas Fisheries Research Institute (TINRO) of Vladivostok, USSR, will leave Los Angeles, California on March 8 to begin a 30-day cooperative study of the distribution of hake spawning stocks off central and southern California. Dr. Gary Stauffer, Fishery Biologist at the La Jolla Laboratory, is coordinating the preparation for the arrival of the Ogon. According to Dr. Stauffer this is the eighth consecutive year of such NMFS cooperation with the Soviets and is a result of bilateral scientific fishery meetings between the U.S. and USSR which has been taking place since 1966.

Hake, an important food fish in the Soviet Union, is heavily fished by the Soviet fleet and Polish fleet within the new 200-mile fishing zone off the Pacific coast and information from the cooperative surveys is necessary to provide a scientific basis for management to conserve this species off the Pacific coast of America. In 1975, the Soviet fishing fleet restricted their catch of hake to 150,000 metric tons.

Present plans are that Messrs. Counts and Flerx will remain aboard the Ogon for 30 days. They will work closely with Soviet ichthyologists and technicians to familiarize them with techniques for collecting plankton and fish samples and to assure standardization of sampling methods. The Ogon will begin occupying the first of 117 biological stations off southern California and gradually work to just north of San Francisco, following tracklines supplied by the La Jolla Laboratory. It seems unlikely, at this time, that the Ogon will enter the Mexican 200-mile limit.

Scientific Leader on the Ogon is Biologist Yuri Demidenko of Tinro, Vladivostok. The vessel, a side trawler, carries a crew of 38, including a scientific party of 7. Since the biological conservation stations to be occupied are within the U.S. 200 mile fisheries conservation zone, the Ogon prominently displays along its port and starboard sides, the words, "Fisheries Research."

The Ogon will return to Los Angeles about April 4 to let off Mr. Flerx and Mr. Counts and unload its collection of plankton samples which, according to agreement, the Soviets will share equally with NMFS fishery biologists at the La Jolla Laboratory. These samples will be examined in detail to help determine the present status of the spawning hake population.

Oceanic Fisheries Resources Division

TUNA RESOURCES PROGRAM

Southwest Fisheries Center's FAX Program Threatened by Lack of Cooperation from Participating Tuna Vessels

An integral part of Southwest Fisheries Center research program is an investigation of the effects of the ocean environment on distribution and and availability of tunas. Data for the investigation are obtained from several sources, including vessels that participate in the Center's FAX program. This is a cooperative effort between participating tuna vessels and the Center with the Center providing and maintaining NMFS-owned FAX machines aboard cooperating tuna vessels and, with assistance from the National Weather Service, providing daily radio broadcasts of environmental charts. The participating tuna vessels in turn agree to radio daily environmental observations to U.S. Department of Commerce-licensed radio station, WWD, operated by the Scripps Institution of Oceanography.

During 1976, 79% of the participating vessels radioed one or more observations to WWD during the entire year, 45% radioed more than 30 observations, and only 6% radioed more than 100 observations (100 observations are considered as the minimum acceptable level).

In a recent letter to the managing owners of participating U.S. tuna vessels, Acting Center Director Izadore Barrett voiced his concern over the continuing lack of cooperation and pointed out that at least 21% of the participating vessels did not bother to cooperate and a very large majority of the vessels did not honor the agreement.

In the coming months of 1977, the Southwest Fisheries Center will monitor the reporting performance of the participating vessels to identify those that continue to disregard the terms of the agreement. If the reporting performance continues low, the Center plans to remove FAX machines from these vessels. Meanwhile the staff at the Center will continue to provide daily environmental charts and advisories and maintenance service for the FAX machines.

Tuna Vessels Participation in FAX Program Continues Decline

During February, 22 U.S. tuna seiners participated in the FAX program of the La Jolla Laboratory. Reporting rates for February were down from February 1976 by 24.9%, as shown below:

February Reporting Rates

	Weather observations	XBT observations	Monthly total	Total - year to date
1976	327	39	366	530
1977	203	5	208	398
Percent change	-37.9%	-87.2%	-43.2%	-24.9%

The tuna seiner Jo Linda led cooperating vessels in February with 25 weather observations sent to the Southwest Fisheries Center. The Jo Linda's reports composed 12% of the total number and congratulations are due Mr. Anthony Guidi, Captain of the Jo Linda.

Eligible Tag Numbers Submitted to ICCAT for March Lotteries

The International Commission for the Conservation of Atlantic Tunas (ICCAT) based in Madrid, Spain, annually conducts lotteries to promote return of tags that are recovered from tunas and tuna-like species. All tag returns of tunas and tuna-like species captured in the Atlantic and its adjacent seas are eligible for the drawings. Two drawings will be held this year in March: one for tags from tropical tunas (yellowfin, skipjack and bigeye) and the other for tags from other tunas and tuna-like species. Each drawing is worth $300 to the recoverer that returned the tag bearing the winning number.

Dr. Gary Sakagawa, at the La Jolla Laboratory, currently serves as ICCAT's U.S. tagging correspondent; he reports that 312 tag returns were submitted to ICCAT for inclusion in this year's lotteries. The tags were from Atlantic tunas and billfishes that were returned to the Woods Hole Oceanographic Institute and the Miami Laboratory of the Southeast Fisheries Center. The tags were put out by biologists of these agencies as well as by recreational fishermen.

Fishing Information Sea Surface Temperature Charts in Fishing Information to Convert to Metric Scale

Mr. James Renner, Editor of Fishing Information, issued monthly by the La Jolla Laboratory, reports that preparation is underway for conversion of sea surface temperature charts of Fishing Information from Fahrenheit to Celsius scale. Conversion is planned to begin with the March issue of the publication.

Verification of address notices were mailed to subscribes to Fishing Information in January and responses have been good thus far. More than 600 subscribers responded. The notice is used to update addresses as well as to identify subscribers that no longer desire to receive the publication.

The January issue of Fishing Information went to press on February 28.

PORPOISE/TUNA INTERACTION PROGRAM

Workshop to Assess Research Related to the Tuna/Porpoise Interaction Problem Held at Center

A workshop to assess research related to the tuna/porpoise problem was held at the Southwest Fisheries Center from February 28 to March 2. This workshop was cosponsored by the Marine Mammal Commission and the National Marine Fisheries Service.

The purpose of the workshop was to identify data needs and to seek advice on avenues of research which hold the greatest promise for solving the problem. Persons heretofore not involved in the planning or conduct of the research program were invited to participate in an attempt to maximize constructive input. Participants were briefed on the results of the 1976 research and on plans for 1977; they were also given the opportunity to express ideas and/or present preliminary research proposals. The workshop report will be widely circulated to elicit comments from a wider segment of interested and knowledgeable persons.

According to Mr. John Everett, Leader of the Porpoise/Tuna program at the La Jolla Laboratory, it was agreed that excellent progress has been made in the areas of fishing gear design and methodology. Further improvements in this area will very likely involve relatively minor modifications to existing developmental configurations. Improvement of this type would include a closer examination of pre-backdown release methods, and the development of technology capable of reducing the incidence of roll-ups. Increased attention should be given to those programs (albeit long-term) which might lead to fishing techniques that do not involve encircling porpoise. It may be possible to separate the tuna from the porpoise before the set and thereby virtually eliminate the kill.

Aerial Survey of Porpoise Populations Interrupted

The Navy-loaned Neptune plane (SP-2H) from the Office of Aircraft Services of the U.S. Department of the Interior, which is the primary survey vehicle for the planned assessment of porpoise populations in the eastern Pacific was forced to abandon work half-way through the scheduled pattern in mid-February and return to San Diego for extensive engine repairs. The time estimated for repair is 2-3 weeks. It is possible that because of the long time lapse all of the lines flown previously will have to be repeated.

According to Mr. John Everett, of the Porpoise/Tuna Interaction program, the interruption has permitted some rescheduling and the plan now is to drop the Tahiti survey lines and add two flights out of Lima, Peru to the schedule. At this time it is anticipated that the Hawaii-based flights will be made.

Results of Cooperative Marine Game Fish Tagging Program for 1976 Available

Tagging experiments help biologists gain valuable information on the seasonal migration and distribution patterns of marine game fish. Mr. James Squire, Fishery Biologist at the La Jolla Laboratory, in charge of the Cooperative Marine Game Fish Tagging Program - Pacific Area reports that results for 1976 total 1,341 billfish tagged. This is a slight increase in number of billfish tagged in 1975 when 1,307 fish were marked. In addition to the tagging of billfish a number of other species such as roosterfish, yellowtail, dolphin, wahoo, shark and sturgeon were tagged--for a grand total of 1,673 fish.

Of the billfish tagged, striped marlin accounted for 626 or 46%. Black marlin totaled 520 fish or 39%, sailfish accounted for 170 or 13%; 25 blue marlin were tagged for 2% of the catch.

Recoveries reported to Mr. Squire at the Southwest Fisheries Center in 1976 were 21, consisting of eight black marlin from tagging off Australia, six striped marlin, two roosterfish and one yellowtail off Baja California, Mexico. Additional recoveries off Australia were of a barracuda and a whaler shark. Off New Zealand a mako shark was recaptured and off southern California a diver-tagged black sea bass was recovered.

Since the Cooperative Marine Game Fish Tagging program began in 1963 certain migration patterns have become evident. Marlin, found throughout the year in varying abundance near the entrance to the Gulf of California, migrate southward and westward in late spring and summer. Some fish round Cape San Lucas and move a short distance northward along the west coast of Baja California. Fish marked in the fall off San Diego, California, show a southward migration toward Cape San Lucas.

The longest migration recorded thus far was that of a striped marlin which traveled from Cape San Lucas to an area 200 miles southwest of Hawaii in three months--a distance of 3,120 nautical miles. A roosterfish holds the record for retaining a tag--733 days. The fish was caught only 18 miles from its tagging location. Among the billfishes, a striped marlin carried a tag for 515 days and was re-caught 285 miles from its tagging location.

Participating in the Cooperative Marine Game Fish Tagging Program for the Pacific Area are NOAA's Southwest Fisheries Center, the Woods Hole Oceanographic Institution, the International Game Fish Association, and the Mexican Department of Fisheries, all of whom furnish equipment and maintain records. The program, however, depends entirely on the cooperation of the sport fisherman who does the tagging.

Mr. Squire distributes the results of the year's tagging activities to a list of more than 2,000 tagging participants.

Index of Apparent Abundance for Important Commercial Fish Species Calculated for 1976

A pelagic airborne fish monitoring program was started by Fishery Biologist James Squire of the La Jolla Laboratory in 1962. The program contracts for the services of aerial fish spotter pilots operating off the California and northwestern Baja California coast for the commercial fleet, to maintain flight log records of their tract, and of species and quantities of fish observed.

The objective of the program is to obtain measures of relative abundance not only for the northern anchovy, but for the other important sport and commercial pelagic species. Species most commonly observed by the contract pilots are the Pacific bonito, northern anchovy, Pacific mackerel, Pacific sardine, jack mackerel and bluefin tuna. Annual abundance indices have been calculated from data derived from the aerial fish spotter flight logs. The aerial data are processed through 1976, making continuous annual records of apparent abundance since 1963 for the major pelagic species.

Mr. Squire reports that the 1976 indices of apparent abundance were calculated from the aerial pelagic fish monitoring flight logs, submitted by contract aerial fish spotters. The amount of flight effort was up substantially in 1976 to the highest recorded level. A total of 17,660 block areas was searched (California Department of Fish and Game block areas which are 10" long x 10" lat areas). During the day operations 14, 122 block areas were searched; 3,544 at night. The latest index of apparent abundance trends are:

Northern anchovy - night index is the primary index, down sharply in 1976 to 5.37 from 11.37 in 1975, 7.9 in 1974 and 14.9 in 1973. Day index is also down in 1976 (1.50) from 3.9 in 1975, 2.0 in 1974 and 2.4 in 1973. The peak abundance level was recorded in 1973. The index level, though down in 1976, when compared to the index peak in 1973, is at a level nearly twice that of any observed prior to 1973.

Jack Mackerel - night index is the primary index up to 0.87 in 1976 from 0.40 in 1975, 0.44 in 1974, and a record low of 0.06 in 1973. In the mid-1960's the night index averaged 1.5 to 2.5. The day index was up only slightly, 0.08 from 0.07 in 1975.

Pacific bonito - day index is the primary index continuing its downward slide from a peak in 1972 (1.11) to a very low level of 0.07. In the mid-1960's the index averaged about the 1.5 levels.

Pacific mackerel - a few schools were sighted in 1976. Day index, 0.0285 from 0.0035 in 1975. Night index up slightly to 0.066 from 0.00 in 1975. Levels in the mid-1960's ranged from 0.2 to 0.9.

Pacific sardine - no pure schools sighted, same for 1974 and 1975.

Bluefin tuna - day index up from 0.13 in 1975 to 0.87 in 1976.

Pacific barracuda - up slightly in 1976, 0.0053 from 0.0029. Yellowtail up slightly in 1976, 0.0015 from 0.0004 in 1975.

These results for 1976 must be examined in the context of the long-term trends shown for each species in the abundance indices over the years; conclusions as to stock condition should not be drawn from one year's index alone.

PACIFIC ENVIRONMENTAL GROUP

OCEAN MODELING AND FORECASTING

NOAA Climate Programs Planned

Climatic anomalies such as those which caused the decline in the Peruvian anchovy fishery and the Russian wheat failures of 1972, the cold fall of 1976 and the frigid winter of 1977 in the eastern U.S. and the drought in the west have had major impacts on the U.S. economy. Bills have been introduced into the House and Senate to establish a National Climate Program. NOAA, too, has been busy trying to coordinate existing climate-related programs with new climate initiatives.

Climate-scale oceanographic programs, of course, are not new in the National Marine Fisheries Service and date back more than 20 years. In 1970, the Pacific Environmental Group (PEG) was established at Monterey with a mission to extract from the data files at Fleet Numerical Weather Central time series of oceanographic and meteorological properties, to develop indices of airsea interaction processes, and to conduct research leading to environmental prediction. As a result of these studies an increasing number of environmental conditions and processes are being found that affect fish populations.

With this history and continuing interest in the effects of climate scale environmental changes on fisheries, NOAA climate programs are of concern to the NMFS. Consequently, during the last year, Mr. G. Seckel, Oceanographer at PEG, has participated in a number of NOAA climate planning meetings.

One new NOAA program to receive some initial funding in FY 1978 is concerned with "climate diagnostics studies." These studies are quite similar to the work done at PEG except that they would be on a much larger scale serving not only fishery needs but also the resource management needs of energy, water, and agriculture. Mr. Seckel serves on a national committee called the "Climate Diagnostics Research Team" which is to establish

scientific objectives and priorities, plans and coordinates the integration of climate diagnostic activities into MLC, NOAA, National and International programs, evaluates research proposals, etc.

In FY 1979 a Climate Diagnostic Center is to be established in NOAA to 1) speed data processing for climate analyses, 2) study recent climatic fluctuations, 3) test cause and effect hypotheses, 4) develop empirical prediction techniques and 5) provide comprehensive climate information to Federal specialists assessing impacts. The proposed Center eventually may have a staff of 32 and a budget of $3.6 million. The Center's work will be concerned with the ocean as well as the atmosphere and thus have fisheries applications, augmenting the climate-scale ocean studies that the NMFS can support.

The program will also plan annual Climate Diagnostic Workshops. This year's workshop is to take place in the third week of October and will be hosted at the Scripps Institution by Mr. J. Namias, pioneer in climate diagnostics and forecasting.

OCEAN CLIMATOLOGY AND MONITORING

For the past several months Dr. Douglas McLain of PEG and Ltjg Dale Bretschneider, detailed to PEG by the NOAA Corps, have been summarizing sea surface temperature observations from magnetic tape files of Fleet Numerical Weather Central. These observations, from all oceans for the period 1972 to the present, will be used to update a time series of sea temperatures developed from historical data of the National Climatic Center extending back as far as 1854. The resulting long time series of sea temperature are useful for many purposes including studies of climatic change and for use in studies of the effects of environmental changes on marine populations. Correlations on water temperature with growth rates have been found in a number of fishes, particularly in shallow, northern waters such as the eastern Bering Sea and the Gulf of Maine. The data are routinely sent to Forrest Miller at the Inter-American Tropical Tuna Commission (IATTC), under contract to the SWFC, to aid in preparation of sea surface temperature summaries in the Tropical Pacific. In addition, copies of the data are being provided to Drs. Jerome Namias and Tim Barnett at Scripps for use in developing sea surface temperature means in the North Atlantic. These data are used in conjunction with Pacific data from SWFC to make experimental climatic forecasts. The forecasting method involves use of empirical orthogonal functions to describe the spatial patterns of sea temperature anomalies and atmospheric circulation. The results to date indicate that useful climatic forecasts can be made for periods as long as 6 months in tropical areas but significantly less in mid-latitudes. The economic implications of such a forecasting ability are large.

TIBURON LABORATORY

PHYSIOLOGY INVESTIGATIONS

Experiments Continue to Determine Effects of Crude Oil Fraction on Spawning Starry Flounder

Experiments continued this month at the Tiburon Laboratory to determine the effects of the water-soluble fraction of crude oil on starry flounder in spawning condition. In addition, the acute tolerances of starry flounder and little neck clams were investigated.

Members of the OCSEAP Task field-collected subsurface water samples and Pacific herring eggs under a Bunker-C oil spill in San Francisco Bay to analyze for the water-soluble fraction. Preliminary results from the water samples indicate that levels of aromatic compounds were below the detection limits of our standard extraction procedures. Extracted samples are presently being concentrated for more sensitive gas-chromatographic analysis.

Laboratory Processing of Striped Bass Specimen Samples Completed

Laboratory processing of specimen samples from last year's striped bass experiments was completed this month. Considerable effort and time were spent measuring individual striped bass larvae, dissecting and identifying stomach contents, and determining dry weights of tissue, oil and yolk. Caloric contents of tissue, oil, yolk and different food organisms were also estimated through bomb calorimetry. Through these measured parameters the effects of different prey concentrations on growth, development and energy budgets will be determined. Analyses of the data and summary results are currently being prepared.

Ossification in fed and unfed larvae was studied through alizarin-stain techniques. Preliminary results of 30-day old, starved larvae showed ossification in the jaw (premaxillary, maxillary, dentary), cleithrum and pharyngeal teeth. Fed larvae, in contrast, were nearly fully ossified. The sequence of ossification is presently being determined.

Detailed objectives for the upcoming striped bass spawning season were decided upon. Primary emphasis will be placed on prey types and concentration and their relation to the metabolic requirements of striped bass larvae and newly metamorphosed juveniles. Other aspects of the experiments will examine a) the effects of ionic compositions of different culture waters, b) point-of-no-return, c) digestion rates and efficiencies, d) food consumption rates, and e) chemical analyses of metabolic substrates.

COASTAL FISH COMMUNITIES INVESTIGATIONS

Economist Joins Rockfish Task

Mr. Edward Ueber, Industrial Economist, joined the staff of the Rockfish Analysis Task at the Tiburon Laboratory this month. His primary duties will involve work with Dr. William Lenarz, Leader of the Rockfish Analysis Task, on a bioeconomic survey of the rockfish fisheries of northern and central California.

Investigation Biologists Attend Meeting of Rockfish Survey Coordinating Committee

Dr. Lenarz and Mr. Peter Adams, Fishery Biologists with the Rockfish Analysis Task, attended a meeting of the Ad Hoc Rockfish Survey Coordinating Committee in Seattle, Washington, on February 15-16. They presented two papers: Adams' paper was entitled "The effects of spatial patterns of rockfish (Genus Sebastes) on sampling strategy"; Lenarz' paper was entitled "Comparisons of random stratified, random, and systematic sampling for rockfish." Both papers will be revised for publication.

During the meeting it was tentatively decided to schedule the coastwide rockfish survey for July-September 1977 from Hueneme Canyon in southern California to the Washington-Canadian border. The California segment of the survey is to occur as early as possible because bocaccio often become less available during late August or early September. Members of Tiburon's Rockfish Analysis Task will participate in the California segment of the study.

Kelp Bed Recreational Fish Communities Task

Task members continue data analysis and manuscript preparation. Dr. Edmund Hobson, Leader of this Task at the Tiburon Laboratory and Fishery Biologist Tony Chess, continued their analysis of collections taken in southern California. In addition, the manuscript "Trophic relationships among fishes and zooplankters in the lagoon at Enewetak atoll, Marshall Islands" was sent to outside reviewers.

FISHERIES DEVELOPMENT INVESTIGATION

Preparations Made to Receive Young Silver Salmon for Pen-Rearing

Mr. R. Green, Fishery Biologist at the Tiburon Laboratory, reports that two pens have been installed for the next batch of salmon, and that they have modified the access ramp to the pens. The Tiburon Laboratory is expecting delivery of the silver salmon from the Mad River hatchery near the end of February at which time they should be ready for salt water.

Lt. Ed Gullekson reports that all the tagging data from last fall's king salmon release have been put on punch cards and that he has verified about 2/3 of the cards.

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Mr. Green and Mr. Richards have begun work on a draft manuscript of a preliminary report of their pen-reared salmon project.

Anglers' Guide to the United States Pacific Coast

This month the color proof of the Anglers' Guide cover layout was received at Tiburon, checked, and then returned to NMFS' Scientific Publications Staff in Seattle.

The Anglers' Guide is a special NMFS publication, coauthored by James L. Squire, Jr., at La Jolla, and Susan Smith at Tiburon. The book describes marine game fish, fishing grounds, and angler facilities along the coasts of California, Oregon, Washington, Alaska, Hawaii, American Samoa and Guam.

Work Continues on Chronology of Changes in Angling Methods

Ms. Susan Smith reports that work continues on the chronology of changes in angling methods and tackle in California. This month's effort centered around organizing information on general overall developments in tackle, and on specific tackle and method changes in California's ocean salmon sport fishery.

HONORS AND AWARDS

Honolulu Laboratory

Mrs. Elizabeth Young was presented a 25-year service pin by Mr. Shomura at the general staff meeting on February 22.

La Jolla Laboratory

Length of service awards were presented by the Acting Center Director Izadore Barrett to Mr. David Kramer, Fishery Biologist, 30 years; Dr. Charles O'Connell, 30 years; and Mr. Jack Metoyer, 20 years.

Tiburon Laboratory

Dr. William Lenarz, Leader of the Rockfish Analysis Task at the Tiburon Laboratory, was named to the Groundfish and Sablefish Fishery Management Plan Development Team of the Pacific Regional Fishery Management Council. The Council also selected Norman Abramson, Director of the Tiburon Laboratory, to serve on the Pink Shrimp Management Team.

The Association of Bay Area Governments, an organization of city and county governments which are in the San Francisco Bay area, requested that Dr. Jeannette Whipple serve on their Environmental Management Program's Technical Advisory Committee of Special Studies. The Committee will be reviewing and analyzing existing information to examine the effects of San Francisco Bay water pollution.

PUBLIC RELATIONS

Honolulu Laboratory

Mr. Uchida, Fishery Biologist at the Honolulu Laboratory served as an associate judge in February at the Ilima Intermediate School and Mililani High School Science Fairs in connection with the 20th Annual Hawaiian Science and Engineering Fair.

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Mr. Tamio Otsu, Leader of the Resource Assessment and Development Investigations at the Honolulu Laboratory, conducted a tour of the Kewalo Research Facility for Japanese students on board the new fishery training vessel, Hokusei Maru (893 tons) of the University of Hokkaido in Japan. The ship is on its maiden voyage and stopped for a week in Honolulu. The vessel capability includes longlining, purse seining, stern trawling, and oceanographic work.

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On February 25 at 7:30 p.m. Mr. R. Shomura, Director of the Honolulu Laboratory, appeared together with two other members of the local fishery community on the Hawaii Educational TV (Channel 11) program "Hawaii Now" and discussed various aspects of the extended jurisdiction law. The show was taped earlier. The second portion of the show will be shown on March 4.

La Jolla Laboratory

Mr. Ken Raymond, Scientific Illustrator, was a featured speaker at the Fifth Annual Dana Point Harbor Festival of Whales on February 5. Mr. Raymond discussed the work of the Center, with particular emphasis on the porpoise research. The event celebrates the winter migration of the California gray whales past the historic Orange County cove named for author-seaman Richard Henry Dana.

Tiburon Laboratory

Mr. Al Molina, College of Marin, Kentfield, California, brought a class of 25 marine biology students to the Tiburon Laboratory for a lecture and tour of their facilities on February 22.

SEMINARS

Honolulu Laboratory

February 8 - Mr. Richard W. Brill, Graduate Student, University of Hawaii, spoke on "Physiological parameter estimations for skipjack tuna (routes of heat loss, stasis respiration, and temperature effects on muscle contraction speeds)."

22 - Dr. Edward Shallenberger, Vice President and Park Director, Sea Life Park in Honolulu, spoke on "Humpback whales in Hawaiian Waters."

La Jolla Laboratory

February 7 - Dr. Robert W. Owen, Jr., "Microstructure of larval fish forage and other substances in southern California waters."

Tiburon Laboratory

Dr. Victor Loosanoff, famous pioneer mariculture researcher and former Senior Scientist with the Bureau of Commercial Fisheries, presented the first of a series of four mariculture seminars on February 18 at the Tiburon Laboratory. His talk was entitled, "A Glance at the Oyster Industry of the United States." Three more seminars on mulluscan mariculture will be given by Dr. Loosanoff at the Tiburon Laboratory at two-week intervals.

MEETINGS AND TRAVEL

February 1 - Dr. Richard Parrish, PEG, traveled to Stanford, California to give a talk at Center for Technology Assessment and Resource Policy (CTARP).

1-2 - Mr. Gunter Seckel, PEG, traveled to Miami, Florida to attend NOAA Climate meeting.

1-3 - Mr. R. Shomura, Director of the Honolulu Laboratory, attended the Western Pacific Regional Fisheries Management Council meeting (2/1-4) and portions of the Pacific Tuna Development Foundation meeting (2/1-2) in Agana, Guam. Other NMFS participants attending the Council meeting were Messrs. Doyle Gates and Robert Iversen (Western Pacific Program Office, Honolulu), Gerald Howard (SWR Director), Izadore Barrett (SWFC Acting Director), and Joseph Slavin (Office of Fisheries Development, Washington, D.C.). Mr. Barrett was named Chairman of the Scientific and Statistical Committee at the Council meeting and Mr. Shomura, Deputy Chairman. Former Honolulu Laboratory employee Dr. Paul Struhsaker was named to the Committee as a crustacean expert.

February 5 - Mickey Eldridge, Fishery Biologist at Tiburon Laboratory, presented a paper titled, "Fate of C-benzene (an aromatic hydrocarbon of crude oil) in a simple food chain of rotifers and Pacific herring larvae" at the annual meeting of the California-Nevada Chapter of the American Fisheries Society held in San Jose.

7-10 - Mr. Shomura was at the Tiburon Laboratory to review the baitfish project and to attend the SWFC Management Meeting in Monterey.

8-10 - The Southwest Fisheries Center Quarterly Management meeting was held at the Pacific Environmental Group in Monterey. Participating from La Jolla were Messrs. I. Barrett, W. Fox, R. Lasker, D. Mackett, and B. Remington. Dr. M. Laurs joined the group on February 9. Mr. Shomura participated from the Honolulu Laboratory; Mr. M. Abramson from the Tiburon Laboratory; Mr. G. Seckel represented the Monterey group.

11 - Mr. Norman Abramson and Dr. William Lenarz visited the California Department of Fish and Game at Menlo Park to discuss a contract under which the Department of Fish and Game will be sampling central and northern California rockfish landings.

14 - Mr. Shomura attended a meeting of the Northwest Hawaiian Islands program called by Dr. Skillman.

14-15 - Dr. Reuben Lasker, Leader of the Coastal Fisheries Resources Division at the La Jolla Laboratory was in Washington, D.C. for a meeting of the Ocean Science Board of which he is a member. He has been asked to participate in discussions on post-International Decade of Ocean Exploration (IDOE) plans (PIP). He met with other scientists in Washington, D.C. to discuss the preparation for workshops to be held in future months on IDOE and also took the opportunity to meet with Director Schoning, Assistant Director Gehringer and Mr. R. Scott.

14-17 - Dr. M. Laurs travelled to Washington, D.C. to attend the NOAA Technical Review Committee Meeting for the NIMBUS color scanner.

- Dr. W. Fox, Leader of the Oceanic Fisheries Resources Division at the La Jolla Laboratory, travelled to Washington, D.C. to brief NMFS Director Schoning, and to attend the tuna/porpoise oversight hearing.

February 15 - Dr. Dan Huppert travelled to Palo Alto to deliver a lecture at Stanford University on Fisheries Management.

15-16 - Dr. William Lenarz and Mr. Peter Adams, Fishery Biologist, attended a meeting of the Ad Hoc Rockfish Survey Coordinating Committee in Seattle to present their design work based on the rockfish pilot survey.

16 - At the invitation of Dr. John Craven, Marine Affairs Coordinator, State of Hawaii, Mr. Shomura attended a "marine breakfast" at the Wisteria Restaurant. The breakfast involved informal discussions about marine affairs among the wide range of people with ocean-related interests.

16-18 - Mr. Mackett, accompanied by Mr. F. Kellenberger, Data Program Manager, travelled to Sacramento, Portland and Seattle for orientation and discussion of Coastwide Data System operations.

- Mr. Gunter Seckel, PEG, travelled to Washington, D.C. to attend meeting of Climate Diagnostic Research Team.

17 - Mr. Shomura attended a public hearing at the State of Hawaii Senate Conference Room on a number of fisheries related bills and resolutions. Of interest to NMFS and the Western Pacific Regional Fishery Management Council was a resolution (S.C.R. No. 30) "requesting the U.S. Department of Navy to permit the operation of commercial fishery station on Midway Islands."

- A CalCOFI meeting was held in the small conference room of the Center. Attending for the Center were Mr. Barrett, Dr. Lasker and Dr. Smith.

- Mickey Eldridge and Jack Scholl, Biological Technicians at the Tiburon Laboratory, visited the California Department of Fish and Game Culture Laboratory at Granite Canyon. The purpose of the visit was to discuss culture methodology of organisms and culture problems of mutual interest.

22 - Mr. Shomura called a general staff meeting to discuss the new Honolulu Laboratory organizational structure and to review research activities resulting from increased responsibility under the Fishery Conservation and Management Act of 1976 (Extended Jurisdiction).

24-25 - Mr. I. Barrett, Acting Center Director, travelled to Honolulu to attend the Scientific and Statistic Committee (SSC) meeting of the Western Pacific Regional Fishery Management Council.

February 24-25 - Mr. Shomura attended the first meeting of the Scientific and Statistical Committee of the Western Pacific Regional Fisheries Management Council in the Honolulu Laboratory conference room. He met on the afternoon of February 25 with Honolulu Laboratory staff members who will serve on the various management teams.

February 28 - March 3 - Dr. Fox in Washington, D.C. to attend meetings with NMFS staff and to attend the Porpoise/Tuna Oversight hearings.

TRAINING

Participants in course in Elementary Statistics given at the Southwest Fisheries Center in La Jolla January-March, 1977 by Dr. Douglas Chapman, Dean of the College of Fisheries at the University of Washington who was on a sabbatical at the Center.

Shown left to right are: Butch Burris, Dick Evans, Doug Chapman, Ron Lynn, Betsy Stevens, Geoff Moser, Joe Caruso, Carol Sanchez, Dave Holts, Gail Theilacker, Larry Eber, Ken Bliss, Mak Kimura, Pete Paloma, Gary Stauffer and Ron Dotson. (Not pictured: B. Butler, B. Flerx, J. Metoyer and R. Miller).

VISITORS

Honolulu Laboratory

February 7-11 - Dr. Dayton L. Alverson, Director, Northwest and Alaska Fisheries Center, Seattle, Washington, and Dr. George Harry, Director, Marine Mammal Division of the NW&AFC, spent several days at the Honolulu Laboratory; they met with Mr. Shomura immediately upon his return on February 11 from the Center Management Meeting.

8 - Mr. Martin Hochman, NOAA General Counsel for the SWR, called on Acting Laboratory Director Richard Barkley.

11 - Mr. Jack Ward of Terminal Island, California, visited Mr. Shomura, at the suggestion of Mr. William Craig of the SWR, to discuss his interest in Hawaiian fisheries.

- Dr. Robert L. Edwards, Director, NEFC, Woods Hole, Massachusetts, and Ms. Helen Mustafa, visited the Laboratory and met separately with Mr. Shomura and other members of Honolulu Laboratory staff.

14 - Dr. Bob Shleser, University of Hawaii Aquaculture Planning Program, met with Mr. Shomura to discuss aquaculture program and projects in Hawaii.

15 - Mr. Cliff Fiscus of the NW&AFC, Seattle, met with Mr. Shomura to discuss marine mammals.

- Mr. Chris Fee, Area Personnel Officer based at Terminal Island, California, visited the Laboratory and met with Mr. Shomura and Mrs. Godfrey, and other Honolulu Laboratory personnel to go over personnel action problems.

22 - G. Wayne Lowdon, Canadian Federal Fisheries Officer, New Westminister, visited the Laboratory; he called on Mr. Shomura.

La Jolla Laboratory

February 14 - Captain and Mrs. Miller J. Tonkel, NOAA, Rockville, Maryland.

17 - Dr. Donald Senich, Division Director, Advanced Energy and Resources Research and Technology, National Science Foundation, Washington, D.C.

24 - Dr. Jay Quast, NMFS, Auke Bay, Alaska at the Center to discuss editorial matters concerned with the Fishery Bulletin with Dr. Reuben Lasker. Dr. Quast may assume the editorship of the journal later this year.

Pacific Environmental Group

February 8 - I. Barrett, R. Lasker, B. Fox, B. Remington, D. Mackett, SWFC; R. Shomura, Honolulu Laboratory; N. Abramson, P. Sund, Tiburon, California; and F. Anders, Southwest Regional Office, Terminal Island, California, all were here to attend the Center Management Meeting.

9 - R. M. Laurs, SWFC, to attend Center Management Meeting.

24 - R. L. Charnell, R.D. Muench, NOAA/PMEL, Seattle, Washington Dr. Morris Schulkin, APL/University of Washington, Seattle.

Tiburon Laboratory

February 1 - John Ward, Chevron USA, Richmond Refinery, Richmond, California and Bill D. Tyree.

3 - Lewis F. Stevens, Fisherman, Nipomo, California.

7 - Richard S. Shomura, Director, Honolulu Laboratory, NMFS, SWFC.

9 - Pete Hermes, Commercial fishing, Hayward, California.

15 - Naoki Kato, Meitetsu, Inc., San Francisco.

- Floyd Anders, Deputy Regional Director, NMFS, SW Region, Terminal Island.

- Robert Pata, NMFS, SW Region, San Francisco.

16 - R. D. Mann, F/M Marketing Co., Santa Rosa, California.

18 - Jim Barry, Moss Landing Marine Labs, California.

18 - John G. Chan, Margaret Bradbury, D. Roberts, San Francisco State University.

- Stephen P. Henderson, International Shellfish Enterprises, Inc., Moss Landing, California.

22 - Ken Eplef and Rich Goldfarb, San Francisco State University.

23 - Karen Sjogren, California Department of Fish and Game, Monterey.

- Joyce Galio, Michael Martin, California Academy of Sciences, San Francisco.

PERSONNEL ACTIONS

January 30 - Alicia K. Rhodes, Clerk-stenographer; Temporary Appointment promotion to secretary - Tiburon Laboratory.

February 3 - Brian J. Lau, Biological Aid (Fisheries, Termination - Honolulu Laboratory.

4 - Charles J. Boyle, Biological Aid (Fisheries), Termination - Honolulu Laboratory.

7 - Rad McLain, Biological Technician and Robert Hundt, Biological Technician, Temporary Appointments - La Jolla Laboratory.

10 - Robert Humphreys, Biological Aid (Fisheries), Temporary Appointment - Honolulu Laboratory.

13 - Peter B. Adams, Fishery Biologist, Promotion - Tiburon Laboratory.

14 - Edward Ueber, Economist, Appointment FTP - Tiburon Laboratory.

- Barbara Sumida, Fishery Biologist, Pay adjustment - La Jolla Laboratory.

- Norman Bartoo, Fishery Biologist, Career appointment - La Jolla Laboratory.

27 - Henry Orr, Illustrator, Conversion to full time - La Jolla Laboratory.

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